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UTILIZATION OF HARDWOOD BROWSE BY MOOSE ON THE TANANA FLOOD PLAIN OF INTERIOR ALASKA

by

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ABSTRACT

The point-center-quarter and Shafer twig-count methods were used to estimate availability of hardwood browse and consumption by moose on the Tanana River flood plain near Fairbanks, Alaska. In 8- and 15-year-old stands, respectively, 38 and 113 kg/ha of available hardwood browse were present. About 55 percent of the available forage was consumed by moose in both areas during the 1974-75 winter. Willows were the most abundant shrubs present and provided the most winter forage for moose.

Keywords: Hardwood browse, Alaska, moose.

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INTRODUCTION

During the winter, moose (*Alces alces*) in Alaska feed primarily on the shoots and branches of willow (*Salix* spp.), birch (*Betula papyrifera*), aspen (*Populus tremuloides*), and balsam poplar (*Populus balsamifera*) (Seemel 1969; LeResche and Davis 1973; Cushwa and Coady, in press). These hardwood plant species are frequently found in early successional stage plant communities established after fire, logging, or alluvial deposits resulting from flood plain processes (Vioreck 1973). Along rivers, active erosion and deposition resulting from spring runoff and occasional flooding create new areas available for the development of early successional stages. Annual production of available forage for browsing mammals is greater during the first 20 years following a disturbance than in later years^{2/} (Spencer and Chatelain 1953, Vioreck 1973). In general, disturbances which occur every 20 years or less result in maximized forage production for browsing mammals.

The willow-dominated early successional stage plant communities, which may occupy from 1 to over 100 ha, occur frequently along the major river systems of interior Alaska and are used as winter foraging grounds by moose. This study was designed to estimate amount of available browse in two areas along the Tanana River flood plain southwest of Fairbanks, Alaska, and to determine the importance of these two areas as winter foraging habitat for moose. These two areas are representative of early seral plant communities, and the results of this study should be applicable to other similar areas along the river.

^{2/} Wolff, J. O. [n.d.] Production of willow browse in a burn and a mature black spruce forest in interior Alaska. Unpublished manuscript. (On file at U.S. Dep. Agric., Pac. Northwest Forest & Range Exp. Stn., Inst. North. For., Fairbanks, Alaska.)

STUDY AREAS

The two study sites were located about 20 km southwest of Fairbanks, Alaska, on recently deposited bars along the Tanana River. The two stands were 8 and 15 years old and supported several species of willow, balsam poplar, alder (*Alnus tenuifolia*), and seedlings of white spruce (*Picea glauca*) (fig. 1).

METHODS

The densities of shrubs and trees in the 8-year-old stand were determined by the point-center-quarter method (Cottam and Curtis 1956) using 40 points. Densities of shrubs and trees in the 15-year-old stand were determined by a modification of the Ohmann-Ream (1971) method. Although the two sampling methods are not known to be comparable, the resultant densities appeared to be reasonable. Pellet group counts were made in forty 250-m² circular plots in each area. The Shafer (1965) twig-count method was used to estimate the availability and utilization of hardwood browse. Estimates of available browse included all twigs less than 4 mm in diameter lying above snowline and within browsing reach of moose. Browsing reach was considered to be between 50 cm and 5 m above the ground. Moose can reach to 3 m and can break taller stems if the diameter at breast height is less than 4 cm.

A brief description of the Shafer twig-count method follows: In May 1975, the total numbers of browsed and unbrowsed branches were counted on 40 to 100 shrubs of each species in each area. Only current annual growth was included in the sampling. The diameter at point of browsing was measured on 50 browsed branches of each species. Fifty unbrowsed twigs of the same



Figure 1.--Photo of the 8-year-old stand along the Tanana River near Fairbanks, Alaska.

diameter were clipped, oven-dried, and weighed in order to determine a mean weight per twig. The weight per twig was multiplied by the number of branches available per shrub and the number of shrubs per hectare to provide an estimate of the total biomass of hardwood browse available to moose per hectare. Only those shrubs which had branches within moose browsing range were sampled. An estimate of browse consumed per hectare was obtained by multiplying the total browse available by the percentage of browsed twigs.

RESULTS AND DISCUSSION

The 8-year-old stand contained about 14,045 stems/ha ($\pm 3,075$, 95-percent confidence interval) with a maximum height of 4 m and the 15-year-old stand had 64,250 stems/ha ($\pm 16,225$, 95-percent confidence interval) with a maximum height of 7 m (table 1). Some plants had as many as five stems, each of which was counted separately. Current amounts of available hardwood browse in the 8- and 15-year-old stands were 37.88 and 113.00 kg/ha, respectively (table 1). Gasaway and Coady (1974) have estimated the mean consumption rate for an average adult moose to be 4 to 6 kg dry weight per day. Their estimate is based on energy requirements and utilization of digestible food. At a consumption rate of about 5 kg/moose/day, the forage available in the 8-year-old stand would support a maximum of 7.6 moose-days/ha (m-d/ha) and that in the 15-year-old stand 22.6 m-d/ha (table 2). Utilization estimates indicated only 21.4 and 62.2 kg/ha were consumed in the 8- and 15-year-old stands, respectively (table 1). This represents 4.3 m-d/ha in the 8-year-old stand and 12.4 m-d/ha in the 15-year-old stand.

Pellet group densities in the 8- and 15-year-old stands were 74 and 164 pellet groups/ha (p.g./ha), respectively, for the 1974-75 winter. A defecation rate on

the two areas of 17.2 and 13.1 p.g./moose/day can be calculated by dividing the pellet groups per hectare by moose-days per hectare. Both figures are within the range of known defecation rates for moose and other ungulates (Julander et al. 1963, DesMueles 1968, Neff 1968).

Franzmann et al. (1976), working on the Kenai Peninsula in Alaska, has recorded a daily defecation rate for moose at 14.6 p.g./ha for females and 19.6 for males. His measurements were made by trailing moose for a 24-hour period and indicate exact figures as opposed to estimates. The results of my study, using an ingestion rate of 5 kg/moose/day, are closely correlated with these results. The moose studied on the Kenai Peninsula are confined to 1-mile-square enclosures and probably consume browse which they would not select if they were free moving. The moose in my study were feeding exclusively on new growth which is probably more digestible than the 2- and 3-year-old birch which moose on the Kenai were consuming. This could account for the lower defecation rates of moose in the interior. Alternatively, moose could be consuming slightly more than 5 kg/moose/day which would increase the estimate of daily defecation rates.

Browse utilization in the 8- and 15-year-old stands was 56 and 55 percent, respectively, for the 1974-75 winter (table 2). Data collected from a 3-year-old burn and a 70-year-old black spruce (*Picea mariana*) forest indicated browse utilization ranging from 8 to 44 percent (see footnote 2). In this study, amounts of available browse averaged 22.6 kg/ha in the burn and 9.9 kg/ha in the spruce stand. Milke (1969), using the clip, dry-weight method, recorded utilization of willow shrubs in the Tanana flats and foothills of interior Alaska of about 38 percent. In his study there were 204 kg of woody browse per hectare.

Table 1--Production of available hardwood browse and consumption by moose on two Tanana flood plain study sites

| Species on study site | Diameter at point of browsing (\bar{x} + S.E.) ¹ | Weight per twig (\bar{x} + S.E.) ¹ | Twigs per stem (\bar{x} + S.E.) ¹ | Forage available per stem | Stems per hectare (\bar{x}) ¹ | Browse produced | Browse consumed | Browse consumed |
|----------------------------|---|---|--|---------------------------|---|-----------------|-----------------|-----------------|
| | mm | g | | g | | kg/ha | kg/ha | Percent |
| 8-year-old stand: | | | | | | | | |
| <i>Salix alaxensis</i> | 3.88 ± 0.04 | 0.83 ± 0.02 | 3.81 ± 0.46 | 3.16 | 8,286 | 26.20 | 14.45 | 55 |
| <i>Salix interior</i> | 2.59 ± .04 | .42 ± .01 | 3.71 ± .49 | 1.56 | 3,371 | 5.25 | 2.98 | 57 |
| <i>Populus balsamifera</i> | 4.05 ± .07 | 1.32 ± .02 | 2.04 ± .17 | 2.69 | 2,388 | 6.43 | 3.99 | 62 |
| Total | | | | | 14,045 (±3,075) ² | 37.88 | 21.42 | 56 |
| 15-year-old stand: | | | | | | | | |
| <i>Salix alaxensis</i> | 4.06 ± .14 | .84 ± .02 | 2.42 ± .18 | 2.03 | 30,000 | 60.90 | 40.19 | 66 |
| <i>Salix novae-angliae</i> | 2.85 ± .08 | .46 ± .01 | 2.83 ± .16 | 1.30 | 27,000 | 35.10 | 19.66 | 56 |
| <i>Salix monticola</i> | 2.85 ± .07 | .46 ± .01 | 3.23 ± .25 | 1.49 | 2,250 | 3.35 | .60 | 18 |
| <i>Populus balsamifera</i> | 4.07 ± .15 | 1.32 ± .02 | 2.07 ± .17 | 2.73 | 5,000 | 13.65 | 1.77 | 13 |
| Total | | | | | 64,250 (±16,225) ² | 113.00 | 62.22 | 55 |

¹Mean ± 1 standard error.²95-percent confidence interval.

Table 2--Food carrying capacity of available hardwood browse and utilization by moose on two Tanana flood plain study sites.

| Study site | Carrying capacity ¹ | Utilization | Available browse utilized | Pellet groups per day |
|-------------------|--------------------------------|---------------------|---------------------------|-----------------------|
| | m-d/ha ² | m-d/ha ² | Percent | |
| 8-year-old stand | 7.6 | 4.3 | 56 | 17.2 |
| 15-year-old stand | 22.6 | 12.4 | 55 | 13.1 |

¹Carrying capacity is defined as the maximum number of days 1 moose can feed on the forage available on 1 hectare of habitat. Calculations are based on a consumption rate of 5 kg/moose/day (Gasaway and Coady 1974).²Moose-day per hectare.

Moose normally consume several twigs with each bite. They also have a tendency to move slowly through a willow patch while feeding. When the available forage is reduced by 50 percent, the number of twigs per bite decreases. The moose then must move more and expend more energy to consume the same quantity of browse. It appears that when the available browse is reduced below a critical density, moose move on to a different area. The new browsing area often supports a different assemblage of plant species which, in turn, provides required diversity in the moose's diet. It is also interesting to note that 50-percent browse utilization may also maximize production of new hardwood browse the next growing season (Krefting et al. 1966 and references cited therein, Spencer and Chatelain 1953; also see footnote 2).

Some Salicaceae species are preferred over others. *Salix alaxensis* is the most common willow species present along the Tanana River and was one of the preferred forage species. *S. novae-angliae* was also common and heavily utilized in the 15-year-old stand. *S. interior* was also a preferred species but is less common. *S. monticola* was not as heavily browsed as the other willow species in the study area. Balsam poplar was heavily utilized in the 8-year-old stand, where it had a higher density and greater number of small branches within browsing reach, than in the 15-year-old stand. In the older stand, many of the trees were less accessible to moose due to larger stems and branches and heights of over 5 m. Alder, which was present at both sites, was not utilized as forage by moose. *Salix lasiandra* and *S. brachycarpa* were also present in low densities in both study areas but were not found in the study plots.

SUMMARY

Amounts of hardwood browse produced and consumption by moose were

estimated in 8- and 15-year-old stands on the Tanana River flood plain near Fairbanks, Alaska. The total amounts of available hardwood browse produced in the two stands were 38 and 113 kg/ha, respectively. Of this, approximately 55 percent of available browse was consumed by moose in 1 year. The early successional stage plant communities on the Tanana flood plain provide an important winter habitat for moose.

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